

REMARKS/ARGUMENTS

Applicant has reviewed and considered the Office Action dated January 14, 2004.

Claims 5-12, 16-22, and 27-34 are cancelled without prejudice or disclaimer; claims 1-4, 13-15, 23-26, 35-44 were previously cancelled; and new claims 45-66 are added to replace the cancelled claims. As a result, claims 45-66 are pending in the present application.

Previously allowable claims 5-11 and 27-33 are now rejected under 35 U.S.C. 103(a) as being unpatentable over Triad Sentinel Article in view of Okada ('318). Previously allowed claims 16-22 are now rejected under 35 U.S.C. 103(a) as being unpatentable over Okada ('318).

Claims 5-11, 16-22, and 27-33 are canceled without prejudice or disclaimer.

New claim 45 recites a system having a solid-state gyro with a sheet of piezoelectric material forming a plurality of piezoelectric elements in a thin-film format, capable of displaying gyroscopic navigational attitude information, direction information, and turn coordinate information simultaneously on a display. New claim 46 recites a solid-state gyro comprising a substrate having a proof-mass; a membrane, the proof-mass being suspended on the membrane; a common electrode layer being disposed on the membrane; a sheet of piezoelectric material in a thin-film format being disposed on the common electrode layer; and a plurality of electrodes being disposed on the sheet of piezoelectric material, the rotational rate signals being outputted through the electrodes, wherein each of the electrodes, the piezoelectric material, and the common electrode layer form a plurality of piezoelectric elements. The recited features are supported by the specification (see at least from page 9, line 15 to page 10, line 18).

Applicant respectfully submits that a sheet of piezoelectric material forming a plurality of piezoelectric elements in a thin-film format is accomplished by depositing the piezoelectric material one molecule or one atom at a time. One of the advantages or features of a thin film is

that the material characteristics in the nearby regions are generally identical. Combining this feature/advantage with the accuracy achieved by thin-film pattern transfer techniques (common in the semiconductor industry) dramatically increases the overall product performance and functionality. The advantages and features of a sheet of piezoelectric material forming a plurality of piezoelectric elements in a thin-film format are described repeatedly in the specification, examples of which are as follows:

- 1] On page 6, lines 11-13, “the piezoelectric elements are made from a single sheet of piezoelectric material so that the elements possess uniform characteristics.”
- 2] On page 7, lines 3-11, the advantages of configuring the gyro and compensation sensors on the same chip are further detailed as providing improved correlation between compensation and gyro signals.
- 3] On page 9, line 15 to page 10, line 18, specific advantages of the thin-film (or “single sheet”) configuration are detailed. One of the most notable advantages is “matching” which provides the high degree of correlation and accuracy both within the gyro and between the gyro and compensation sensors in a single-chip arrangement such as Figure 12.
- 4] Figure 4 illustrates the shared sheet of piezoelectric material, while Figure 5 shows the top view embodiment of element arrangement on the piezoelectric material.
- 5] Figure 12a illustrates a common sheet of piezoelectric material utilized to achieve a plurality of sensors with a high degree of correlation (accuracy). The plurality of sensors on the single chip may be a) both rotational sensors (gyros) responding to different axes of rotation, b) a rotational sensor (gyro) along with a

- compensation sensor, or c) a plurality of compensation sensors responsive to different stimuli requiring compensation (i.e. vibration along different directions).
- 6] Figure 13 illustrates a simplified top view of a single chip containing a plurality of correlated sensors.
- 7] On page 23, line 19, the advantage of single-sheet (thin film) piezoelectric material is reiterated, "The piezoelectric elements are made from a single sheet of piezoelectric material so that the elements possess uniform characteristics."
- 8] On page 25, line 1, the advantage of single-sheet (thin film) is further reiterated: "By utilizing a single common layer for the lower electrode layer 171 and the piezoelectric thin film 172, matching between elements and element density is increased, and these factors improve the gyro's signal fidelity."
- 9] On page 26, line 5, the advantage further reiterated: "The amount of 'off-axis rejection' is largely contributed by the symmetry of the pairs, matching of the elements, and precision placement. Such arrangement reduces the systematic drift and random noise normally present in a rotational rate sensor, thereby dramatically improving the performance of the system 100."
- 10] On page 27, line 11, the advantage further reiterated: "This feedback mode of operation provides immunity to temperature variation and other environmental anomalies and improves the overall fidelity of the gyro performance. The quality of piezoelectric matching and symmetry enable this mode of operation."
- 11] On page 30, line 6 to page 30, line 10, the advantage of multi-sensor chip with shared single sheet of thin film piezoelectric material is detailed: "The advantage of this embodiment is that compensation signals are highly correlated to the

rotational sensor signals. The high correlation is resulted from the fact, but not limited to, that the sensors are physically located in very close proximity and witness the same effects, manufactured using the same fabrication steps, and affected in a similar manner by temperature and electronic noise due to their similar structure. At the system or subsystem level, the multi-sensor chip also provides an improved degree of accuracy and compensation.”

Applicant respectfully submits that none of the cited references disclose or teach forming a plurality of piezoelectric elements on a thin-film format. The rationale for forming a plurality of piezoelectric elements on a thin-film format greatly extends beyond miniaturization and cost reduction, since the embodiment of a thin film provides novel and inventive advantages in end-product performance. By contrast, Okada describes a bulk-machined device with no teachings or contemplation of a thin-film embodiment or reduction to a semiconductor chip (i.e. solid-state). Instead, Okada ('318) teaches embodiments that make conventional bulk manufacturing more cost effective. Bulk manufacturing refers to the conventional methods of machining individual sensor elements and then assembling with adhesives. In the case of the Okada, the oscillating member (220), piezoelectric washer (250), lower washer electrode (E20), etc. are produced independently and subsequently fixed to each other. Okada makes specific statements with regard to the form of the device, for instance, Okada discloses in col. 34, lines 7-13, “Alternatively, there may be employed a configuration such that twelve individual electrode layers are arranged on the upper surface and the other twelve individual electrode layers are arranged on the lower surface of the piezoelectric element 250 without using a common electrode layer. It should be noted that it is preferable to form the common electrode layer for the purpose of simplifying wiring.” Accordingly, Okada teaches away from using a common

electrode layer. Nowhere in Okada or Triad Sentinel Article do they disclose or teach a solid-state gyro with a sheet of piezoelectric material forming a plurality of piezoelectric elements in a thin-film format as recited in claims 45, 46, 53, and 60. Accordingly, Applicant respectfully submits that claims 45-66 patentably distinguish over Triad Sentinel Article in view of Okada, alone or in combination.

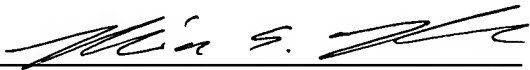
In view of the above, it is respectfully submitted that the present application is in condition for allowance. Reconsideration of the application and a favorable response are respectfully requested.

If a telephone conference would be helpful in resolving any remaining issues, please contact the undersigned at 612-752-7367.

Respectfully submitted,

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